HI I'M FROM PACIFIC NORTHWEST NATIONAL LABORATORY. WE ARE GOING TO BE TALKING TO YOU TODAY ABOUT ASHRAE, IESNA, AND STANDARD POINT 1999 AND GIVING YOU MORE IN-DEPTH COVERAGE THAN WE DID LAST YEAR. I WOULD LIKE TO WELCOME OUR NATIONAL AUDIENCE. WE HAVE ABOUT 160 SITES REGISTERED WITH US. AS WELL AS OUR STUDIO AUDIENCE HERE PROVIDED TO US BY COOPERATION WITH THE INLAND EMPIRE CHAPTER OF ASHRAE. WE ARE HAPPY TO HAVE YOU HERE IN THE STUDIO WITH US. I WOULD LIKE TO WELCOME OUR DISTINGUISHED PRESENTERS. I WILL BE INTRODUCING EACH OF THOSE IN THE RESPECTIVE SEGMENTS. ALSO NEED TO RECOGNIZE THE SPONSORS THE DEPARTMENT OF ENERGY, ASHRAE AND IESNA. THE FORMAT FOR THE BROADCAST WILL BE IN THREE SEPARATE SEGMENTS. ONE ON THE ENVELOPE, A SECOND ON THE MECHANICAL AND A THIRD ON THE LIGHTING. EACH OF THE SEGMENTS WILL THEN BE FOLLOWED BY A QUESTION AND ANSWER PERIOD AND A BRIEF INTERMISSION. WE WILL BE TALKING ABOUT THE '99 STANDARD TODAY. WE WILL MAKE REFERENCES TO THE 2001 STANDARD. ASHRAE HAS PUBLISHED A NUMBER OF ADDENDA AND CHANGES TO THE 1999 STANDARD. THOSE ARE BEING FOLDED INTO A NEW PRINTED VERSION OF THE 2001. IT WILL BE SUBMITTED TO THE MODEL CODE ORGANIZATIONS FOR THEIR APPROVAL. I'M SURE YOU'LL ALL WANT TO KNOW WHERE TO GET THE STANDARD. WE SHOULD HAVE ON THE SCREEN A GRAPHIC THAT GIVES THE INFORMATION FOR THE ASHRAE BOOK STORE, PHONE NUMBERS, AS WELL AS THE WEBSITE. I UNDERSTAND THE STANDARD IS PRINTED. IN FACT, WE BELIEVE SOME COPIES ARE ON THEIR WAY FEDERAL EXPRESS OUT HERE TO US IN SPOKANE. HOPEFULLY IF WE GET THEM WE CAN HOLD THEM UP FOR YOU. I WOULD ALSO LIKE TO MENTION, BECAUSE THE IMPORTANCE OF THE STANDARD OBVIOUSLY COMES WHEN THE STATES ADOPT THE STANDARDS. ON THE SCREEN YOU SHOULD SEE A MAP THAT INDICATES THE STATUS OF STATE ADOPTION. STATES SHOWN IN PURPLE ARE STATES WHO CURRENTLY MEET OR EXCEED THE '89 VERSION, THE PREVIOUS VERSION TO THE '99. THE RED ARE ONES THAT MEET OR EXCEED '99. THE YELLOW STATES ARE THOSE THAT ARE IN THE PROCESS. THESE ARE BASED ON INFORMATION THAT'S REPORTED BY THE STATES TO THE DEPARTMENT OF ENERGY. THERE MAY BE SOME SUBSEQUENT PROGRESS ON THIS. SO, THAT'S SORT OF WHAT'S IMPORTANT HERE ABOUT THIS. NOW, LET'S MOVE INTO THE CONTENT OF OUR PRESENTATION. I WOULD LIKE TO INTRODUCE OUR FIRST PRESENTER, MERYL MCBRIDE FROM OWENS CORNING. HE SERVED AS THE PAST CHAIRMAN OF PRIOR TO MY TENURE. THANK YOU, RON.

WELCOME EVERYBODY TO THE SATELLITE BROADCAST. I APPRECIATE THE OPPORTUNITY TO PRESENT THE ENVELOPE REQUIREMENTS. MY INTENT IS TO PROVIDE INSIGHTS NOT AVAILABLE JUST BY READING OF THE STANDARD. THE OVERVIEW OF MY PRESENTATION IS DIVIDED INTO SIX TOPICS. FIRST WE WILL HAVE A DESCRIPTION OF THE BACKGROUND

AND THE DEVELOPMENT PROCESS. THIS WILL EXPLAIN THE UNDERLYING DECISION AND ASSUMPTIONS THAT WENT INTO THE CREATION OF THE STANDARD. FROM THERE WE WILL SHIFT TO THE FOCUS AND THE CRY TIER YEAH AND COMPLIANCE AND INCLUDE COMPARISONS TO THE 1999 STANDARD. I'LL FINISH UP WITH THE DISCUSSIONS ON ERRATA AND ADDENDA AND FINALLY QUESTIONS AT THE END OF THE PRESENTATION. THE FIRST TOPIC DEALS WITH THE BACKGROUND THAT LED UP TO THE DEVELOPMENT OF THE 1999 STANDARD. WHAT I INTEND TO DO IS EXPLAIN THE MAJOR UNDERLYING DIFFERENCES BETWEEN THE TWO STANDARDS FOCUSING ON THE DEVELOPMENT PROCESS AND THE STRINGENCY LEVELS. IN TERMS OF BACKGROUND THERE WERE FOUR KEY ISSUES THAT WERE CRITICAL. THE FIRST ONE WAS THE CRITERIA DEVELOPMENT USED TO DEVELOP THE STANDARD. IN 1989 THE PRIMARY FOCUS WAS PROFESSIONAL JUDGMENT. THE ONLY EXCEPTION TO THAT WAS AN ECONOMIC ANALYSIS THAT WAS USED TO DETERMINE PIPE INSULATION REQUIREMENTS. THAT WAS SUBJECT TO PUBLIC COMMENTS AND CRITICISM IN 1999 WE ELECTED TO USE ECONOMIC ANALYSIS AS THE PRIMARY FOCUS BUT TEMPER THAT WITH PROFESSIONAL JUDGMENT AS NECESSARY. THE SECOND MAJOR DIFFERENCE IS THE SIMPLIFIED CRITERIA IN '89 WE ARE ESSENTIALLY LOOKING AT ENVELOPE CRITERIA IN TERMS OF U-FACTORS. IN 1989 WE WANTED TO FURTHER SIMPLIFY THAT, WE PRESENT THAT IN TERMS OF INSULATION R-VALUES. THE THIRD KEY ISSUE IS THE COMPONENT TRADE OFFICE. IN THE 1989 THE BASIS FOR THAT WAS EQUAL ENERGY CONSUMPTION. THIS IS REALLY CRITICAL TO UNDERSTAND THE DIFFERENCES. FOR 1999 THE REQUIREMENT IS EQUAL ENERGY COSTS. SO WE HAVE A FUNDAMENTAL DIFFERENCE IN TERMS OF THE TWO STANDARDS. IN 1989 THE TRADE-OFFS FOR THE ENVELOPE WERE LIMITED TO WINDOWS AND WALLS. WE WANTED TO EXPAND THAT IN 1999, WE CAN DO TRADE-OFFS FOR THE ENTIRE ENVELOPE. IN TERMS OF THE CRITERIA DEVELOPMENT FOR THE 1999 WE HAD THREE MAJOR TECHNICAL OBJECTIVES. IT HAD TO BE TECHNICALLY FEASIBLE. IT WAS ONLY TO ANALYZE THE ACTUAL PRODUCTS. WE WEREN'T LOOKING FOR CONSTRUCTION IN THE FUTURE. WE ARE LOOKING AT WHAT'S AVAILABLE OFF THE SHELF TODAY. SECOND, WE WANTED TO MAKE SURE THE STANDARD WAS ECONOMICALLY JUSTIFIED. OUR APPROACH WAS WE USED LIFE-CYCLE COST ANALYSIS. FINALLY, WE WANTED THE STANDARD TO BE BALANCED. WE DID THAT AS PART OF OUR LIFE CYCLE. WE'LL EXPLAIN THAT IN DETAIL LATER. IF WE LOOK AT WHAT WE MEAN BY BALANCE, WHAT I HAVE HERE IS A GRAPH THAT SHOWS THE RELATIVE STRINGENCY OF THE – PRIMARILY THE ENVELOPE, MECHANICAL AND LIGHTING. PERCEPTION WAS IN 1989 THE ENVELOPE WAS STRINGENT AND THAT THE MECHANICAL WAS IN TERMS OF RELATIVE STRINGENCY, NOT AS TIGHT, AND LIGHTING WAS THE LEAST. WHAT WE HOPE TO DO IN THE 1999 STANDARD WAS BRING THEM ALL UP TO EQUIVALENT LEVELS OF STRINGENCY. WE DID THIS BY APPLYING PROFESSIONAL JUDGMENT. THE

MAGNITUDE OF THESE ARE NOT ABSOLUTE VALUES. THEY ARE RELATIVE. I'M NOT GETTING THE – THERE WE GO. THE CRITERIA DEVELOPMENT WE WANT TO LOOK AT WAS DONE THROUGH A RIGOROUS PROCESS. IT WAS TEMPERED WITH PROFESSIONAL JUDGMENT. WE MODELED INDIVIDUAL COMPONENTS. LOOKED AT THERMAL AND ECONOMIC PERFORMANCE AND COUPLED THAT -- IN TERMS OF THE ACTUAL MODELING I WOULD LIKE TO STEP THROUGH THE NONRESIDENTIAL CRITERIA. WE STARTED WITH OUR MODELING ASSUMPTIONS AND LOOK AT BUILDING TYPES. WE FOUND RETAIL AND OFFICE BUILDINGS ACCOUNTED FOR ABOUT 50% OF NEW BUILDINGS. IN MODELING THOSE WE ASSIGNED THE HVAC SYSTEMS TO BE ROOFTOP UNITS, GAS FIRED EVAPORATIVE COOLING. FUEL PRICES WE USED NATIONAL AVERAGE PRICES. SINCE THE ENVELOPE CRITERIA IS CLIMATE SENSITIVE WE LOOKED AT 11 DIFFERENT CITIES AROUND THE COUNTRY AND ENVELOPE REGIONS. MERYL, AS I LOOK AT THE INFORMATION, I'M SURE A LOT OF OUR VIEWERS AROUND THE COUNTRY ARE LOOKING AT THE FUEL PRICES AND THINKING ABOUT HOW CLOSE THEY MAY BE TO THEIR OWN LOCAL PRICES. I WONDER IF YOU MIGHT ELABORATE ON THE BASIS FOR THESE NUMBERS? WE STARTED WITH USING NATIONAL AVERAGES JUST AS A NUMERICAL CALCULATION. IF YOU DO THAT AND COUPLE IT WITH ECONOMICS, WHAT YOU FIND IS THAT YOU COULD JUSTIFY DIFFERENT ENVELOPE REQUIREMENTS WITH DIFFERENT FUEL TYPES AND DIFFERENT FUEL COSTS. SO WE ACTUALLY WENT THROUGH THE EXERCISE AND DEVELOPED CRITERIA FOR A GAS SYSTEM AND ELECTRIC RESISTANCE AND PUT THAT OUT FOR PUBLIC REVIEW. IT WAS SO CONTROVERSIAL IT DIDN'T SURVIVE THE PUBLIC REVIEW PROCESS. WE WANTED TO INCORPORATE THAT KIND OF TECHNOLOGY INTO THE STANDARDS. FOR THE HEATING PRICE WE USED A BLENDED COST 95% BASED ON NATURAL GAS 5% BASED ON THE COST OF -- ELECTRICAL COST OF HEAT. THE 66 IS A BLENDED NUMBER. LOU CAN'T FIND IT AS A NUMERICAL AVERAGE OF ELECTRICAL DATA. THANKS, MERYL. TO COMPLETE OUR ANALYSIS, WE STARTED WITH MODELING A RETAIL BUILDING. IF YOU LOOK AT IT, YOU MIGHT THINK IT WAS ARCHITECTURALLY CHALLENGED. I REFER TO IT AS AN ENGINEER'S DREAM. WHY IS THAT? FIRST OF ALL, IT'S VERY SIMPLE GEOMETRY. IT HAS A CORE ZONE. IT HAS FOUR PERIMETER ZONES. WE COULD CHANGE HE FENESTRATION EXPOSURE FROM ZERO TO 50% TO THE WINDOW TO WALL RATIO. SO THIS GAVE US A LOT OF FLEXIBILITY TO GO THROUGH AND START DOING OUR THERMAL AND ECONOMIC ANALYSIS FOR RETAIL BUILDINGS. WE ALSO LOOKED AT OFFICE BUILDINGS AND WE GOT CREATIVE. WE PUT ONE STORE ON TOP OF THE OTHER. WHAT'S IMPORTANT TO RECOGNIZE IN THIS IS THAT WE COMPLETED DETAILED SIMULATIONS ON A FULL RANGE OF CONSTRUCTION OPTIONS FOR EACH ENVELOPE COMPONENT. FOR EXAMPLE, ON THE ROOF CEILING WE DID ANALYSIS FROM NO INSULATION TO R-100 USING EXISTING PRODUCTS. WE LET THE ECONOMICS DETERMINE WHAT WAS ACTUALLY COST

EFFECTIVE FOR EACH OF THE INDIVIDUAL CLIMATE REGIONS. THIS WAS THE APPROACH TAKEN FOR EACH OF THE MAJOR SECTIONS OF STANDARD. WE ARE LOOKING AT THIS IN TERMS OF THE NONRESIDENTIAL REQUIREMENTS. WHEN WE LOOKED AT MODELING RESIDENTIAL BUILDINGS, WE CHANGED THE HOURS OF OPERATION. E CHANGED THE OCCUPANCY LEVELS, CHANGED LIGHTING LEVELS. WE DID THIS TO BE CONSISTENT WITH THE STANDARD. NOW, JUST TO SHOW THAT REAL BUILDINGS CAN LOOK LIKE OUR MODELS. THIS IS THE ACTUAL BUILDING WHERE I WORK. NOW THE END RESULT OF ALL THIS MODELING WAS THE DEVELOPMENT OF THE ENVELOPE CRITERIA. SO THAT I WOULD LIKE TO FOCUS ON THE CRITERIA AND COMPARE IT TO THE 1989 STANDARD. IF WE LOOK AT THE CRITERIA WE HAVE FIRST MANDATORY PROBATIONS THAT HAVE TO BE MET REGARDLESS OF WHAT COMPLIANCE PATH IS SELECTED. THERE ARE THREE COMPLIANCE PATHS THAT YOU CAN SELECT. THE FIRST ONE IS THE PRESCRIPTIVE PATH. THAT IS THE SIMPLEST. THERE ARE A COUPLE OF RESTRICTIONS. FIRST THE WINDOW WALL RATIOS HAS TO BE LESS THAN 50% AND SKYLIGHTS HAVE TO BE LESS THAN 5% OF THE TOTAL ROOF AREA. IF YOU MEET THOSE TWO REQUIREMENTS YOU CAN USE THIS PATH. IF YOU WANT TO LOOK AT MORE SOPHISTICATED CRITERIA, YOU CAN USE THE ENVELOPE TRADE-OFF PROCEDURE. THAT ALLOWS YOU TO INCREASE THE GLAZING AREA BEYOND 50%. IF YOU WANT TO GO FURTHER AND TRADE OFF WHOLE BUILDING, YOU CAN LOOK AT THE ENERGY COST METHOD AND EVALUATE ENVELOPE, MECHANICAL AND LIGHTING TRADEOFFS. TO GET INTO THE INDIVIDUAL CRITERIA WE NEED TO START WITH A GENERAL DEFINITION OF SOME OF THE BUILDING ELEMENTS. FIRST IS A CONDITION SPACE. FOR THIS, I HAVE IT SHOWN AS THIS SPACE IN THE CENTER OF THE BUILDING. THIS IS A SPACE THAT HAS A COOLING SENSIBLE CAPACITY OF FIVE BTU HOURS PER SQUARE FOOT. HEATING CAPACITY RAGES FROM FIVE TO 30 BTU HOURS PER SQUARE FOOT. IT IS DESIGNED FOR HUMAN COMFORT. THE ENVELOPE CRITERIA BETWEEN THE CONDITION SPACE AND EXTERIOR IS HAVING THE LARGEST TEMPERATURE DIFFERENCE AND YOU MEET THE CONDITION SPACE CRITERIA. HOWEVER, IF THE CONDITION SPACE IS ADJACENT TO SOME OTHER SPACE, FOR INSTANCE SEMI-HEATED SPACE, THE CRITERIA ISN'T AS STRINGENT. THERE YOU MEET THE SEMI-HEATED CRITERIA. FROM THERE IF YOU GO TO THE OUTSIDE, IT'S THE SEMI-HEATED. THERE ARE TWO DIFFERENT CRITERIA THAT HAVE TO BE MET DEPENDED ON THE USE IN SPACE. THE LAST IS AN UNCONDITIONED SPACE, AND THE EXTERIOR WALL FOR THAT HAS NO CRITERIA SO THAT'S EASY TO DEMONSTRATE COMPLIANCE. OUR CRITERIA ARE CLIMATE SENSITIVE. WE HAVE DONE A LOT IN LOOKING AT THE CLIMATIC DATA. WE HAVE IDENTIFIED TWO WEATHER VARIABLES. WE ARE LOOKING AT COOLING DEGREE-DAYS TO BASE 50. THAT'S BASED ON MODELING AND REPRESENTS ESSENTIALLY THE BALANCE POINT FOR COOLING IN BUILDINGS. THE HORIZONTAL ACCESS IS HEATING DEGREE-DAYS TO BASE 65. THAT'S USED PRIMARILY FOR

HISTORICAL REASONS. IT'S ALSO REASONABLE FOR A BALANCE POINT OF COMMERCIAL APPLICATION. IF WE LOOK AT THE GRAPH, WE SEE THE DATA HAS A DEFINED CONTOUR. THERE'S NO WEATHER DATA THAT MEETS THE CLIMATES EITHER IN TERMS OF SEVERE COMBINATIONS OF HEATING AND COOLING OR MINIMAL AMOUNT OF HEATING AND COOLING COMBINATIONS. WE ARE LOOKING AT THE REGIONS TO DEFINE THE CLIMATE. IN THE 1989 STANDARD THERE WERE FIVE WEATHER VARIABLES THAT DEFINED THE CLIMATES. IT MADE IT MORE DIFFICULT TO SET UP AND DEVELOP THE ENVELOPE CRITERIA. EACH DIFFERENT COLOR REGION DEFINES A CLIMATE BIN. THE SIZE OF THESE BINS ARE DEFINED IN INCREMENTS OF 900 AND THE REASON FOR THAT IS THE MULTIPLE CONVERSION TO SKI MAKES IT 500. SO THE TWO STANDARDS HAVE INTEGER INCREMENTS. THE BLACK SQUARES REPRESENT THE POINTS WHERE THE CALCULATIONS WERE USED FOR THE ANALYSIS. IF WE LOOK AT THIS POINT, IT WAS OUR FIRST CLIMATE ZONE, AND WE START GOING DOWN NUMBERING IN SEQUENCE NUMBER 2, WHICH WOULD BE A PLACE LIKE MIAMI, FLORIDA. 3 AND CLIMATE ZONE 4 INCLUDES THIS POINT, AS WELL AS ANYTHING THAT WOULD OCCUR DOWN TO ZERO BELOW THAT. THERE'S NOT ANY CLIMATES DOWN THERE. WE ARE CALCULATING IT AS A POINT WHERE IT MAY REFLECT ACTUAL CLIMATIC DATA. AS WE CONTINUE LOOKING AT SEVERITY WE GET TO THE MIDDLE OF THE COUNTRY. THIS IS REPRESENTATIVE OF CLIMATE ZONE 13 CONTAINING ST. LOUIS. AND WE GET TO CLIMATE ZONE 19, WHICH IS REPRESENTATIVE OF BISMARCK, NORTH DAKOTA. FINALLY YOU END UP WITH SEVERITY OF ALASKA CLIMATES AND BEYOND. THIS FORM IS GOOD FOR ALL CLIMATIC STANDARDS. IF WE WANT TO SEE WHERE THE REGIONS EXIST -- WE HAVE A MAP TRYING TO SHOW THOSE. START WITH CLIMATE ZONE 2 SHOWING MIAMI CLIMATE ZONE 3, CLIMATE ZONE 4. YOU START TO SEE A BAND THAT GOES AROUND THE COUNTRY TO PICK UP OTHER REGIONS. IT GETS VERY COMPLICATED. IF YOU HAVE LOCATIONS THAT ARE NOT LISTED IN THE STANDARD, YOU HAVE TWO OPTIONS. FIRST SELECT THE LOCATION THAT BEST REPRESENTS THE CLIMATIC CONDITIONS WITH THE CONSTRUCTION SITE BEING ANALYZED. IF YOU DON'T WANT TO DO THAT OR IF YOU HAVE RECORDED HISTORICAL DATA, YOU CAN USE THAT PROVIDED IT'S APPROVED BY THE LOCAL BUILDING OFFICIAL. WE THINK WE HAVE THE U.S. CLIMATES PRETTY WELL COVERED. NEXT I WANT TO GET INTO ARE THE GENERAL REQUIREMENTS OF SPACE CONDITIONING CATEGORIES. THEY ARE DEFINED BY THE USE CHARACTERISTICS OF THE OCCUPANTS. IT REQUIRES NO CALCULATION. HAT'S A TREMENDOUS SIMPLIFICATION. IF YOU LOOKING AT NONRESIDENTIAL SPACE, THAT'S WHERE PEOPLE WORK. RESIDENTIAL SPACE IS WHERE PEOPLE LIVE. SEMI-HEATED SPACE IS FOR STORAGE AND NOT DESIGNED FOR THERMAL COMFORT. CONTRAST THAT TO THE 1989 STANDARD WHERE THERE'S ELABORATE CALCULATION YOU HAD TO GO THROUGH TO DETERMINE THE BUILDING CRITERIA BASED ON INTERNAL LOAD DENSITY WHICH IS THE FUNCTION

OF LIGHTING POWER DENSITY, EQUIPMENT POWER DENSITY, OCCUPANT LOAD ADJUSTMENTS. A LOT OF CALCULATIONS AND VALUES HAD TO BE KNOWN. WE FEEL THIS IS A TREMENDOUS SIMPLIFICATION IN BEING ABLE TO USE THE STANDARD. CAN'T GO WITH THE GENERAL REQUIREMENTS. WE HAVE A DESIGN REQUIREMENT FOR CONDITION SPACES. IF YOU ARE LOOKING AT A BUILDING THAT MAY BE A SPEC OFFICE BUILDING, OR YOU ARE NOT SURE WHAT WILL GO INTO IT, THE REQUIREMENTS AND STANDARDS ARE YOU HAVE TO ASSUME THAT IT WILL BE CONDITION SPACE AT THE TIME OF CONSTRUCTION REGARDLESS OF WHETHER MECHANICAL OR ELECTRICAL EQUIPMENT IS INCLUDED IN THE BUILDING PERMIT OR INSTALLED AT THAT TIME, UNLESS YOU CAN MEET SOME OF THE RESTRICTIONS WHERE IT'S MAYBE SEMI-HEATED OR UNCONDITIONED AND APPROVED BY THE BUILDING OFFICIAL, THEN YOU SPECIFY THAT ON THE FLOOR PLANS. IN ADDITION TO GENERAL REQUIREMENTS, WE HAVE MANDATORY CRITERIA. THIS COVERS THREE BROAD TOPICS, INSULATION, FENESTRATION AND AIR LEAKAGE. I WILL REVIEW EACH OF THESE IN DETAIL. IN TERMS OF INSULATION, THIS IS REQUIRED FOR ALL COMPLIANCE PATHS. FIRST THE INSULATION MUST BE INSTALLED PER MANUFACTURER'S RECOMMENDATION TO ACHIEVE THE RATED R-VALUE. THERE ARE OTHER REQUIREMENTS. IF IT'S LOOSE FILL INSULATION, YOU CAN INSTALL IT IF THE SLOPE OF THE APPLICATION IS MORE THAN 3 AND 12, AND IF IT'S IN AN ATTIC IT REQUIRES BAFFLES SO YOU ARE NOT HAVING AIR BLOW THE INSULATION BACK FROM THE EAVES. THEN WE HAVE EXCEPTIONS. THE FIRST EXCEPTION IS FOR METAL BUILDINGS. THE ROOF AND WALL INSULATION CAN BE COMPRESSED BECAUSE THAT'S NORMAL APPLICATION. YOU DON'T NEED TO MEET THE MANUFACTURE'S INSTALLED R-VALUE AS THE PRODUCT IS MANUFACTURED. SECOND REQUIREMENT IS THAT YOU HAVE TO HAVE THE INSULATION IN SUBSTANTIAL CONTACT WITH THE INSIDE SURFACE. THIS IS TO AVOID HAVING AIR CAVITIES AND SETTING UP CONVEX CURRENTS. THERE IS EXCEPTIONS. IF YOU HAVE REFLECTIVE INSULATION THAT RELY ON AIR SPACE, THAT IS PERMITTED. THE THIRD REQUIREMENT DEALS WITH RECESSED EQUIPMENT, LIGHTING FIXTURES, HVAC EQUIPMENT, AND DUCTS. THEY ARE NOT TO AFFECT THE INSULATION THICKNESS. WE WANT TO KEEP FULL INSULATION THICKNESS AND R-VALUE. THERE'S AT LEAST ONE EXCEPTION TO EVERY RULE. IN THIS CASE IF YOU DO AN AREA WEIGHTED CALCULATION AND THE COMPRESSED INSULATION IS LESS THAN ONE PERCENT OF THE GROSS AREA THAT IS DEEMED ACCEPTABLE FOR DEMONSTRATING COMPLIANCE. NEXT IT DEALS WITH SUSPENDED CEILINGS. WITH REMOVABLE CEILING PANELS, WE ARE NOT ALLOWING THOSE TO BE BACK LOADED AND ACHIEVE DEMONSTRATING COMPLIANCE WITH THE STANDARD. YOU NEED TO HAVE ROOF INSULATION OR INSULATION UNDERNEATH THE DECK IN THOSE KIND OF APPLICATIONS. FINALLY, IF THERE'S ANY EXTERIOR INSULATION IT NEEDS TO BE PROTECTED. IF IT'S BELOW GRADE, THERE'S A REQUIREMENT FOR WATER ABSORPTION THAT

HAS TO BE MET. IF WE LOOK AT THE MANDATORY REQUIREMENTS FOR FENESTRATION INDOORS, THE FIRST SPECIFICATION IN TERMS OF THE USE OF FACTOR, AND THIS HAS TO BE DETERMINED FOR UNITS THAT ARE PRODUCTION LINE OR THAT COULD BE PURCHASED BY THE CONSUMER. THEY HAVE TO DETERMINE COMPLIANCE IN ACCORDANCE TO THE NATIONAL FENESTRATION STANDARD. THE TEST HAS TO BE DONE BY AN ACCREDITED LABORATORY. ACH UNIT HAS TO BE LABELED BY THE MANUFACTURER. IN 1989 WE DIDN'T HAVE THIS LEVEL OF SPECIFICATIONS IN THE STANDARD. OF COURSE WE HAVE A SERIES OF EXCEPTIONS. IF IT'S NOT A STANDARD PRODUCTION UNIT THAT SOMETHING IS SITE BUILT, THEN WE HAVE CRITERIA IN THE STANDARD THAT CAN BE USED FOR DEFAULT VALUES FOR DEMONSTRATING U-VALUE REQUIREMENTS. IF YOU WANT TO TAKE CREDIT FOR CODINGS, THERE HAS TO BE NFRC COMPLIANCE. IF YOU HAVE VERTICAL FENESTRATION, FOR INSTANCE GLASS BLOCKS THAT DOES NOT HAVE AN NFRC RATING, YOU CAN U-VALUES IN THE APPENDIX TO THE STANDARD. FINALLY OPAQUE DOORS HAVE AN NFRC STANDARD FOR DEMONSTRATING COMPLIANCE. GARAGE DOORS HAVE THE STANDARD BY THE NATIONAL ASSOCIATION OF GARAGE DOOR MANUFACTURERS. THERE ARE A LOT OF SPECIFICATIONS FOR INDIVIDUAL PRODUCTS THAT GO INTO CONSTRUCTION OF THE ENVELOPE. THERE'S CRITERIA FOR SOLAR HEAT GAIN COEFFICIENT. IT HAS TO BE DETERMINED IN ACCORDANCE WITH THE NFRC STANDARDS DONE BY AN ACCREDITED LABORATORY AND LABELED BY THE MANUFACTURER. EXCEPTION IS IF YOU DON’T HAVE THAT, YOU CAN TAKE THE SHADING COEFFICIENT MULTIPLY BY 86 AND THAT WILL GIVE YOU THE HEAT GAIN FACTOR FOR THE ENTIRE ASSEMBLY. IF YOU ONLY HAVE CENTER OF GLASS, YOU ALSO CAN USE THAT AS THE SOLAR HEAT COEFFICIENT. GLAZE WALL SYSTEMS AND VERTICAL FENESTRATIONS DEFAULT VALUES ARE LISTED IN THE STANDARD THAT CAN BE USED TO DEMONSTRATE COMPLIANCE. FINALLY ON FENESTRATION IF YOU WANT TO USE DYE LIGHTING CREDITS AND YOU NEED TO VALIDATE THE VISIBLE LIGHT TRANSMISSIONS OF THE FENESTRATION, IT HAS TO BE NFRC RATED AND VERIFIED BY THE MANUFACTURER IN ORDER TO TAKE THE CREDITS. ALL RIGHT, SWITCHING FROM THAT TO AIR LEAKAGE. IT'S IMPORTANT TO UNDERSTAND THAT THERE IS NO CRITERIA IN THE STANDARD ON AIR TIGHTNESS OF THE ENVELOPE. HOWEVER THERE ARE CRITERIA TO MINIMIZE AIR LEAKAGE BY SEALING, CAULKING, GASKETING AND WEATHER STRIPPING. WHERE IS THAT APPLIED? WE TELL YOU TO LOOK AT JOINTS AROUND FENESTRATION AND DOORFRAMES, JUNCTIONS BETWEEN WALLS AND ROOFS, UTILITY SERVICE OPENINGS, SITE BUILT FENESTRATION, DUCTS AND PLENUMS, VAPOR JOINTS, AND ANY OTHER OPENING IN THE BUILDING ENVELOPE. IF THAT ISN'T ENOUGH, WE FURTHER OUTLINE WHERE YOU NEED TO SEAL IN TERMS OF OUTSIDE AIR INTAKES, EXHAUST OUTLETS, RELIEF OUTLETS, STAIR SHAFTS, ELEVATOR SHAFTS, SMOKE RELIEF OPENINGS. THERE'S A COUPLE REQUIREMENTS IN

THE MECHANICAL SECTION FOR SHUT OFF DAMPER CONTROLS AND GRAVITY VENT CONTROLS. THE REQUIREMENTS FOR AIR LEAKAGE FOR INDIVIDUAL PRODUCTS IN TERMS OF FENESTRATION AND DOORS HAVE TO MEET NATIONAL FENESTRATING RATING STANDARDS. FOR SWINGING AND RESOLVING DOORS THE NEW REQUIREMENT IS 1 CFM PER SQUARE FOOT. IN THE 1989 IT WAS 1 1/2 PER SQUARE FOOT. ALL THERE PRODUCTS ARE .4 CFM PER SQUARE FOOT. WE HAVE EXCEPTIONS FOR FIELD-FABRICATED UNITS, GARAGE DOORS. WE ALSO HAD AN EXCEPTION IN TERMS OF AN AIR LEAKAGE TEST. THAT EXPIRED SO THAT'S NO LONGER GERMANE. CONTINUING WITH THE MANDATORY REQUIREMENTS, WE HAVE ADDED REQUIREMENTS FOR LOADING DOCK WEATHER SEALS IN LOCATIONS ABOVE 3600 HEATING DEGREE-DAYS. THAT'S SHOWN ON THIS MAP BY ALL OF THE LOCATIONS THAT AREA BLACK CIRCLE. IF IT'S BELOW 3600, THEN IT'S SOME COLOR. THE LOADING DOCK WEATHER SEALS ARE NOT REQUIRED. THE WEATHER SEALS ARE REQUIRED TO RESTRICT INFILTRATION WHEN VEHICLES ARE PARKED IN THE DOORWAY. ANOTHER MANDATORY REQUIREMENT WE HAVE IS VESTIBULES, BUT THEY ARE NOT REQUIRED IN LOCATIONS BELOW 1800 HEATING DEGREE-DAYS. AGAIN THAT WOULD BE THE AREAS THAT SHOW UP AS THE COLOR. IF IT'S A BLACK CIRCLE, VESTIBULES ARE REQUIRED. THE CRITERIA ARE, ALL EXTERIOR DOORS HAVE A VESTIBULE. WE WANT TO HAVE SEVEN FEET BETWEEN THE INTERIOR DOOR AND EXTERIOR DOOR TO AVOID HAVING BOTH DOORS OPEN AT SAME TIME. FINALLY EACH DOOR SHALL HAVE A SELF-CLOSING DEVICE. IF YOU ARE LESS THAN 1800 HEATING DEGREE-DAYS, THAT'S NOT REQUIRED. IF YOUR STORY IS LESS THAN FOUR, IT'S NOT REQUIRED. IT'S ALSO NOT REQUIRED FOR MECHANICAL AND EQUIPMENT DOORS OR IF YOU HAVE DIRECT ACCESS FROM A DWELLING UNIT. IF YOU HAVE A SMALL BUILDING LESS THAN 3,000 SQUARE FEET, IT'S NOT REQUIRED. IT'S NOT REQUIRED ON A REVOLVING DOOR OR VEHICULAR MOVEMENT AND HANDLES DOORS AS WELL. MERYL, THE VESTIBULE CRITERIA, THAT IS ONE OF THE NEW CRITERIA FROM THE 1989 STANDARD? EXACTLY RIGHT, RON. IN 1989 THE STANDARD STATED DUE TO STACK EFFECTS IN MULTI-STORY BUILDINGS, YOU SHOULD CONSIDER THEM BUT THEY WERE NOT REQUIRED. THANKS. IF WE LOOK AT PRESCRIPTIVE CRITERIA, IT'S PRESENTED IN TERMS OF U-FACTORS FOR ROOF WALLS AND FLOORS AND FENESTRATION. THERMAL CONDUCTIVITY OF MATERIALS FOR THE BELOW GRADE EXCLUDED THE OIL AND AIR FILL. WE PRESENT IT IN TERMS OF SEA FACTOR FOR SLAB. ON GRADE WE USE F-FACTORS. WE ALSO PRESENT IT IN TERMS OF R-VALUES FOR ROOFS, WALLS, FLOORS, AND SLABS AND OCCASIONALLY THERE'S EXCEPTIONS. WE HAVE NO REQUIREMENTS. SO YOU'LL SEE AN "NR" LISTED IN THE TABLES. FOR SOLAR HEAT GAIN COEFFICIENTS WE HAVE THAT HEAT GAIN CRITERIA FOR -- WHEN YOU ARE DOING THE PRESCRIPTIVE CRITERIA, THERE'S CERTAIN PROCEDURES THAT ARE ALLOWED, AND WHAT ARE ALLOWED YOU CAN AIR WEIGHT WITHIN A SINGLE CLASS OF CONSTRUCTION THE U-VALUES THE C-VALUES. YOU

CANNOT AIR WEIGHT R-VALUES. YOU ARE NOT ALLOWED TO AIR WEIGHT ALONG MULTIPLE CLASSES OF CONSTRUCTION OR ACROSS SPACE CONDITIONING CATEGORIES. ALL RIGHT. THOSE COMPLETE THE MANDATORY REQUIREMENTS. NEXT I WOULD LIKE TO LOOK AT THE ACTUAL PRESCRIPTIVE CRITERIA, AND MY FOCUS IS TO STEP THROUGH THE MAJOR ELEMENTS OF A TABLE THAT SHOWS THE CRITERIA. I WANT TO SHOW A LAYOUT OF THE CRITERIA BEFORE WE GET INTO THE ACTUAL STRINGENCY OF THE CRITERIA ITSELF. IT STARTS BY HAVING A BIN NUMBER, WHICH IDENTIFIES THE TABLE. THIS IS DETERMINED BY THE CLIMATIC DATA, WHICH IS AVAILABLE IN APPENDIX D OF THE STANDARD. THIS ONE TABLE PRESENTS THE ENTIRE CRITERIA FOR A GIVEN LOCATION. FOR THAT GIVEN BIN NUMBER, WE ALSO PRESENT THE CLIMATIC DATA RANGES. THIS IS REFERENCE INFORMATION. SO IF YOU ARE TRYING TO USE HISTORICAL DATA, YOU CAN MAKE SURE YOU GET INTO THE RIGHT CRITERIA TABLE. IT IS BROKEN DOWN INTO TWO MAJOR ELEMENTS. FIRST WE LOOK AT OPAQUE ELEMENTS AND WHAT THE REQUIREMENTS ARE. AND IN CONJUNCTION WITH THAT WE ALSO LOOK AT THE FENESTRATION CRITERIA. THOSE TWO ARE THE MAJOR CRITERIA FOR THE ENVELOPE. THEN WE DIVIDE IT BY THE BUILDING CATEGORIES. THE FIRST COLUMN SHOWS THE NONRESIDENTIAL. IF YOU ARE BUILDING A NONRESIDENTIAL BUILDING, THIS IS THE ONLY CRITERIA YOU NEED TO LOOK AT. YOU CAN IGNORE THE OTHER TWO. NEXT ONE BEING NONRESIDENTIAL BUILDINGS ARE OCCUPANCIES DEFINED AS OTHER THAN RESIDENTIAL. EXCLUDES SPACES WHOSE PRIMARY FUNCTIONS ARE INDUSTRIAL PROCESSING. FOR INSTANCE, A BLAST FURNACE AREA. I HAVE LISTED SOME OF THE TYPICAL CONSTRUCTIONS THAT WOULD BE CONSIDERED NONRESIDENTIAL. WHEN WE LOOK AT THE RESIDENTIAL CRITERIA, THIS IS SPACE IN BUILDINGS USED PRIMARILY FOR LIVING AND SLEEPING. EXAMPLES OF THAT WOULD BE DORMITORY, HOSPITAL PATIENT ROOMS, HEALTH CARE, HOTEL/MOTEL GUEST ROOMS. MULTI-FAMILY HIGH RISE AS SHOWN IN THE PICTURE. PENITENTIARY, POLICE STATIONS, FIRE STATIONS. THESE ARE THE DWELLING UNITS THAT WOULD BE COVERED UNDER THE RESIDENTIAL CRITERIA. THE LAST COLUMN IS THE SEMI-HEATED CRITERIA. THIS IS PRIMARILY LOOKING AT WAREHOUSES ARE SEMI-HEATED. DEFINITION OF A SEMI-HEATED SPACE IS AN ENCLOSED SPACE OF THE BUILDING THAT IS HEATED BY A HEATING SYSTEM WHOSE OUTPUT CAPACITY IS GREATER OR EQUAL TO 3.4 BTU PER AREA OF FLOOR AREA. WE ARE ASSUMING THEY ARE HEATED TO 50 DEGREES FOR STORAGE AND NOT SATISFY HUMAN COMFORT CONDITIONS. ALL RIGHT. SO THAT IS THE GENERAL LAYOUT OF THE CRITERIA. NEXT I WOULD LIKE TO WORK THROUGH A SPECIFIC EXAMPLE. I HAVE SELECTED ST.. LOUIS. IT'S HEARTLAND OF THE COUNTRY. IT HAS A GOOD BALANCE OF HEATING AND COOLING. I DON'T THINK IT HURTS THE FACT THAT IT'S ALSO THE HOMETOWN OF OUR CURRENT ASHRAE PRESIDENT MR. BILL COE. IF YOU ARE OUT THERE BILL, THIS IS FOR YOU. GOOD MOVE, MERYL. GOOD MOVE. JUST FOR CALIBRATING, IF WE LOOK

BACK AT THE CRITERIA IN TERMS OF CLIMACTIC LOCATIONS, THE GREEN ZONE REPRESENTS CLIMATE BIN 13. THE BLACK IS THE POINT WHERE THE CALCULATIONS WERE DONE, AND THE RED SYMBOL REPRESENTS THE ACTUAL LOCATION OF ST. LOUIS. SO YOU CAN SEE WE ARE RIGHT IN THE HEART OF THIS CLIMATIC BIN. THE HEATING DEGREE-DAYS ARE 4,758. COOLING IS 4,283. IT'S A GOOD COMPLIMENT OF HEATING AND COOLING REQUIREMENTS. NOW WE ARE GOING TO WORK THROUGH THE DETAILS OF WHAT CONSTITUTES THE ACTUAL CRITERIA. FIRST I WANT TO START WITH LOOKING AT THE ROOF. FIRST THING YOU NOTICE IS THAT WE HAVE CRITERIA FOR THREE DIFFERENT TYPES OF ROOF CONSTRUCTION. INSULATION ENTIRELY ABOVE DECK, METAL BUILDINGS, ATTIC AND OTHER SPACES. THIS IS A MAJOR DIFFERENCE FROM THE 1989 STANDARD WHERE WE HAD ONE-ROOF CRITERIA THAT APPLIED TO ALL BUILDING ROOFS. WHAT YOU CAN SEE HERE IS THAT THE MAXIMUM ASSEMBLY U-VALUE, FOR INSTANCE, INSULATION ABOVE DECK AND METAL BUILDINGS IS ROUGHLY THE SAME, BUT FOR ATTICS AND OTHER SPACES IT IS MORE STRINGENT. IF YOU DON'T WANT TO USE AN ASSEMBLY U-VALUE TO DEMONSTRATE COMPLIANCE, GO OVER AND LOOK AT THE MINIMUM INSULATION R-VALUES. ENTIRELY ABOVE DECK WE HAVE LISTED AN R-VALUE OF 15. BEHIND THAT IS CI. THIS IS STANDING FOR CONTINUOUS INSULATION. THAT'S NOT TO BE INTERRUPTED BY ANY STRUCTURAL OR FRAMING MEMBERS FOR METAL BUILDINGS YOU HAVE AN R-19 REQUIREMENT. IN OTHER LOCATIONS YOU MAY SEE TWO VALUES LISTED. THE FIRST IS FOR THE DRAPED INSULATION OVER THE PURLOINS. IT MAY OR MAY NOT REQUIRE ONE-INCH THERMAL BLOCK THE SECOND, IF LISTED IS PARALLEL TO THE PURLINS. WE HAVE EXCEPTIONS TO ROOF CRITERIA WHERE YOU CAN ACTUALLY DECREASE THE PROPOSED U-FACTOR IF YOU PROVIDED THE EXTERIOR ROOF IS YOUR VAST AS A SOLAR RELUCTANT GRATER THAN .7 AND THERMAL GREATER THAN .75. A COUPLE POINTS I NEED TO HIGHLIGHT THAT AREN'T OBVIOUS BY LOOKING AT THE CRITERIA ITSELF. FIRST THESE THREE ROOF CRITERIA DO NOT ASSUME THEY WILL CONSUME EQUAL ENERGY CONSUMPTION IN THE BUILDING. BECAUSE OUR CRITERIA WAS BASED ON ECONOMICS AND WE ARE USING DIFFERENT INSULATION MATERIALS WE HAVE DIFFERENT FIRST COSTS SO WE HAVE DIFFERENT LEVELS OF STRINGENCY. IT’S DRIVEN BY ECONOMICS. FINALLY IF YOU LOOK THROUGH ALL OF THE 26 TABLES, YOU FIND THE MINIMUM CRITERIA IS R-13. THAT WAS A CONSCIOUS DECISION TO USE THAT AS A MINIMUM STARTING LEVEL. SO HOW DOES THIS COMPARE TO THE EXISTING STANDARD? THIS IS A GRAPH THAT SHOWS THE U-FACTOR OF THE CRITERIA PLOTTED ON A VERTICAL SCALE AND HEATING DEGREES ON THE HORIZONTAL AXIS. WE SEE A LOT OF SCATTER REPRESENTED BY THE 1989 IN THE LOWER HEATING DEGREE-DAYS. THIS IS BECAUSE OF THE INFLUENCE OF THE COOLING PARAMETERS IN THE ROOF EQUATION IN 1989. FOR ONE CLIMATE FROM THE NEXT WE SEE A WIDE RANGE THAT'S ALLOWED AND THIS GETS INTO A LOT OF QUESTIONS ABOUT WHAT'S COST EFFECTIVE.

WHEN WE APPLIED THAT IN THE 1999 STANDARD, WE SEE WE HAVE EXISTING PRODUCTS AND DEFINES DISCRETE LEVELS. WE ARE NOT LOOKING AT INTERMEDIATE POINTS THAT DON'T REFLECT ACTUAL PRODUCT COMBINATIONS. FINALLY YOU SEE FOR ABOVE DECK AND METAL BUILDINGS THE INSULATION IS FAIRLY CONSISTENT. FOR ATTICS AND OTHERS THERE IS A MORE STRINGENT CRITERIA. WHEN WE LOOK AT THIS OVER ALL THERE, IS A FUNDAMENTAL DIFFERENCE IN TERMS OF A SPECIFIC LOCATION. IF YOU TRY TO INTEGRATE THIS ACROSS THE COUNTRY, IT MIGHT NOT BE THAT MUCH DIFFERENCE. LOOKING FOR ST. LOUIS THERE ARE 4700 HEATING DEGREE-DAYS. FROM ROOFS WE LOOK AT THE WALL CRITERIA IT IS DIVIDED IN TWO MAJOR SECTIONS, WALLS ABOVE GRADE, WALLS BELOW GRADE. FOR WALLS ABOVE GRADE IT IS DIVIDED INTO THREE. MASS WALLS, METAL BUILDINGS, STEEL FRAMED AND WOOD FRAMED, AND OTHER CONSTRUCTION. AGAIN THE CRITERIA FOR EACH OF THESE ARE MEETING THE COST EFFECTIVENESS, NOT THAT EACH OF THESE WILL GIVE YOU THE SAME ENERGY PERFORMANCE FOR THE BUILDING. FOR THE MASS WALLS THE U-VALUE REQUIREMENT CAN BE MET AND IN THIS CASE IT WOULD BE A CONCRETE BLOCK WITH UNGROUTED CORES FILLED WITH A MATERIAL HAVING A CONDUCTIVITY OF LESS THAN 0.44. IF YOU WANT TO USE INSULATION ON THE SURFACE RATHER THAN FILLING THE CAVITIES, YOU CAN APPLY AN R-5.7 CONTINUOUS INSULATION. IT WOULD BE INSTALLED WITH METAL CLIPS NOT WITH WOOD OR STEEL FRAMING THE METAL BUILDING R-13 YOU SEE IS THE MINIMUM. THAT'S ALSO FOR STEEL AND WOOD FRAMED WALLS. THE WALLS BELOW GRADE THE CRITERIA IS THERMAL CONDUCTANCE, C-VALUE. IN THIS CASE THIS IS A BARE WALL WITH NO INSULATION, SO THE INSULATION R-VALUE IS LISTED AS NO REQUIREMENT. COMPARING THE WALL CRITERIA TO THE 1989, THE '89 VALUE IS AGAIN SHOWN AS THE BLUE VALUE. WE START OUT IN VERY WARM CLIMATES OF HAVING A U-FACTOR OF 1, THEN IT FOLLOWS THIS CURVE DOWN. AND AGAIN WE ARE LOOKING AT U-FACTORS THAT DON'T NECESSARILY RELATE TO EXISTING INSULATION PRODUCTS. WHEN WE LOOK AT THE 1999 CRITERIA, WE SEE DEFINITIVE STEP CHANGES BECAUSE WE GO FROM ONE LEVEL PRODUCT TO THE NEXT, FOR MASS CONSTRUCTION. IF WE ARE LOOKING AT ALL OTHER WALLS THEY ARE PRETTY MUCH CONSISTENT WITH ABOVE 3,000 HEATING AGREE DAYS WITH THE 1999 STANDARD. IF WE LOOK AT ST. LOUIS, WE ARE AT A POINT RIGHT HERE AND YOU PROBABLY WON'T SEE A SIGNIFICANT DIFFERENCE IN CONSTRUCTION REQUIREMENT. IF WE LOOK AT BELOW GRADE COMPARISONS, WE HAVE A MAJOR DIFFERENCE IN THE NEW STANDARD. NO INSULATION REQUIREMENTS UNTIL YOU HIT ABOUT 9,000 HEATING DEGREE-DAYS, WHICH IS MOST OF THE CONTINENTAL U.S. THEN IT JUMPS UP TO AN R-8 FOR THE REST OF THE COUNTRY. CONTRASTING THAT TO THE '89 STANDARD THERE WAS NO REQUIREMENT TO 3,000, WHICH IS ABOUT A CLIMATE EQUIVALENT TO ATLANTA OR SAN FRANCISCO, AND THEN THE R-VALUE INCREASES LINEARLY. IT IS STEPPING THROUGH R-VALUES THAT DON'T RELATE TO A

SPECIFIC PRODUCT. IF YOU ARE DEMONSTRATING COMPLIANCE, YOU WOULD PROBABLY HAVE TO USE HIGHER LEVELS OF INSULATION THAT WERE ACTUALLY REQUIRED IN THE '89 STANDARD. IF WE LOOK AT FLOOR CRITERIA, AGAIN WE HAVE TWO TYPES OF FLOORS. THE FIRST CATEGORY DIVIDES FLOORS INTO MASS, STEEL FRAMING, AND WOOD FRAMING AND OTHER. YOU'LL NOTICE THAT THE MASS FLOOR CRITERIA IS ABOUT TWICE THE VALUE OF THE STEEL AND WOOD FRAMED. YOU CAN SEE THAT REFLECTED IN THE INSULATION REQUIREMENTS IN TERMS OF R-VALUES. WHEN WE GO TO SLAB ON GRADE, WE HAVE TWO CATEGORIES. WE HAVE HEATED AND UNHEATED SLABS. THE CRITERIA THERE ARE IN TERMS OF F-FACTORS. FOR AN UNHEATED SLAB IN ST. LOUIS THERE'S NO REQUIREMENT. IF IT IS HEATED, WITH IN GROUND PIPES OR DUCTS, THEN YOU HAVE TO HAVE AN R-VALUE OF 7.5. THAT HAS TO BE CONTINUOUS FOR 24 INCHES OFF THE EDGE OF THE SLAB. WE HAVE SOME DRAWINGS THAT REFLECT SOME OF THE TYPE OF CONSTRUCTIONS. IN TERMS OF THE MASS FLOOR CONSTRUCTION, YOU HAVE AN OPPORTUNITY, YOU COULD INSULATE ABOVE THE MASS, OR IF YOU WANT TO PUT THE INSULATION BELOW, YOU CAN PUT THAT UNDERNEATH THE SLAB, AND THAT'S ASSUMING THE FLOOR IS SUPPORTED WITH EITHER WOOD OR JOIST CONSTRUCTION OF STEEL. ANOTHER OPTION IS THAT YOU CAN RAP THE INSIDE OF THE CONCRETE, IF IT'S A WAFFLE-TYPE CONSTRUCTION, WITH INSULATION CONTINUOUSLY. THE THIRD CATEGORY IS IF YOU HAVE FLOORS WITH BEAMS. THE INSULATION ON THE UNDERNEATH SIDE HAS TO BE CONTINUOUS HORIZONTALLY. VERTICALLY IT HAS TO EXTEND DOWN 24 INCHES. IF WE LOOK AT STEEL JOIST FLOOR WE HAVE SIMILAR OPTIONS. YOU CAN INSULATE ABOVE THE DECK. IF YOU GO BELOW THE DECK YOU HAVE TO HAVE INSULATION IN THE CAVITY OR YOU CAN PUT A RIDGED INSULATION UNDERNEATH THE STEEL AND COMPLETELY FILL UP THE CAVITY. AGAIN YOU HAVE TO DEMONSTRATE U-VALUE COMPLIANCE WITH THESE CONSTRUCTIONS. WOOD FRAME FLOORS FOLLOW WHAT WE SEE IN STEEL FRAMED. YOU CAN INSULATE ABOVE THE SUB FLOOR. FILL IN BETWEEN THE CAVITIES OR PUT UNDERNEATH AND FILL UP THE ENTIRE CAVITY. COMPARISONS, AGAIN FOR THE 1989 STANDARD WE HAVE THE BLUE REQUIREMENTS AND WE ARE SHOWING THIS GRADUAL TREND LOOKING AT U-VALUES THAT DON'T TIE INTO SPECIFIC PRODUCTS. WHEN WE LOOK AT ACTUAL PRODUCTS, WE HAVE DISCRETE LEVELS AND THEY CHANGE DEPENDING ON THE APPLICATION. IF WE LOOK AT ST. LOUIS, AGAIN 4700, WE HAVE SOME CRITERIA THAT ARE LESS STRINGENT, SOME MORE STRINGENT. DEPENDING ON THE APPLICATION, YOU MAY HAVE TO MAKE A CONSTRUCTION CHANGE. THE SLAB ON GRADE CONSTRUCTION HAS REQUIREMENTS THAT THE INSULATION HAS TO EXTEND FROM THE TOP OF THE SLAB DOWN TO THE TOP OF THE FOOTER OR IF THAT DEPTH IS GREATER SPECIFIED DOWN TO 24 INCHES, THEN THAT'S ALL THE FAR YOU WOULD HAVE TO CARRY IT. IF THERE ARE REQUIREMENTS THAT YOU HAVE TO HAVE MORE, YOU CAN GO DOWN TO THE BOTTOM OF THE FOOTER AND GO HORIZONTALLY. YOU

CAN GO DOWN PARTWAY AND EXTEND OUT FURTHER THIS WAY. THOSE ARE OPTIONS ON HOW YOU WANT TO INSTALL THE INSULATION. IF WE LOOK AT THE CRITERIA COMPARED TO THE '89, THE BLUE LINES REPRESENT THE '89 CRITERIA. THEY START AT 3,000 HEATING DEGREE-DAYS AND YOU SEE THAT WE HAVE DIFFERENT REQUIREMENTS DEPENDING ON THE DEPTH AND R-VALUE OF THE INSULATION. AGAIN THIS LEADS YOU TO REQUIREMENTS THAT MAY NOT TIE INTO EXISTING PRODUCTS. THE 1999 STANDARD HAS NO REQUIREMENTS FOR SLAB THAT ARE UNHEATED UP TO A LITTLE OVER 10,500 HEATING DEGREE DAYS. THEN IT JUMPS TO AN R-10. IF YOU HAVE A HEATED SLAB IT STARTS AT R-7.5. AROUND 5,000 IT JUMPS TO R-10 AND CONTINUES. WE HAVE MAJOR DIFFERENCES IN SLAB INSULATION REQUIREMENTS. THE NEXT ELEMENT IS DEALING WITH OPAQUE DOORS AND THIS IS A NEW REQUIREMENT. THERE WAS NO SEPARATE REQUIREMENT IN THE '89 STANDARD FOR DOORS AT ALL. FOR 1999 WE HAVE BROKEN IT DOWN TO SWINGING DOORS AND NON-SWINGING DOORS AND HAVE SEPARATE CRITERIA FOR THOSE. THIS IS SOMETHING NEW IN THE STANDARD. IF WE LOOK AT HOW THAT COMPARES AROUND THE COUNTRY, WE SEE THAT FOR THE SWINGING DOOR WE ARE LOOKING AT A U-VALUE OF .7 FOR PRETTY MUCH THE ENTIRE CONTINENTAL U.S. AS WE GET INTO COLD CLIMATES IT GETS MORE STRINGENT. FOR NON-SWINGING DOORS THERE IS A BASE LEVEL THAT CHANGES AT ABOUT 7,000 HEATING DEGREE-DAYS. THIS IS A NEW REQUIREMENT FOR ST. LOUIS. WE ARE LOOKING AT ONE OF THOSE TWO VALUES AS THE DOOR CRITERIA; SWITCHING FROM THE OPAQUE TO THE FENESTRATION REQUIREMENTS OF THE STANDARD WE HAVE THE PORTION THAT LISTS VERTICAL GLAZING AS A FUNCTION OF THE WALL AREA. IT'S BROKEN INTO FOUR CATEGORIES; ZERO TO 10 PERCENT, 10 TO 20, 20 TO 30, 30 TO 40, AND 40 TO 50%. THE U-FACTOR VARIES DEPENDING ON WHETHER IT'S FIXED GLAZING OR OPERABLE. WE HAVE A SEPARATE U-VALUE SPECIFIED FOR SOLAR HEAT WE HAVE ONE VALUE LISTED FOR ALL ORIENTATIONS. HOWEVER THERE ARE EXCEPTIONS TO THAT. THIS DEALS WITH THE CRITERIA THAT'S LISTED AS NORTH. IF YOUR LATITUDE IS GREATER THAN 10 DEGREES NORTH LATITUDE THEN YOU CAN USE ON NORTH FACING ORIENTATIONS THE NORTH SOLAR HEAT GAIN CRITERIA. IF YOU HAVE PERMANENT PROJECTIONS THAT SHADE SOME OTHER ORIENTATION, YOU CAN ALSO USE THE NORTH ORIENTATION. FINALLY YOU CAN ALSO USE THIS ON STREET SIDE OF STREET LEVEL, ASSUMING THE HEIGHT OF THE FIRST FLOOR IS LESS THAN 20 FEET, PROJECTION FACTORS IS LESS THAN .5. SO, THERE ARE SEVERAL EXCEPTIONS THAT MAKE THIS MORE AMENABLE TO RETAIL SHOPS ON GROUND LEVEL. I NOTICED IN LOOKING AT THE FENESTRATION TABLES THE UPPER LEVEL FOR THE CRITERIA IS 50% WINDOW WALL RATIO. MY GUESS IS THERE'S SOME ARCHITECTS OUT THERE AND PEOPLE IN THE GLAZING BUSINESS THAT ARE WONDERING IF THEY WILL BE ABLE TO HAVE BUILDINGS THAT EXCEED 50% WINDOW WALL RATIO UNDER THE STANDARD. COULD YOU ELABORATE ON THAT? CERTAINLY, RON. EXCELLENT QUESTION. WHAT

WE ARE REVIEWING ARE THE PRESCRIPTIVE CRITERIA THAT DOESN'T LIMIT GLAZING TO 50%. IF IT'S THE CHOICE TO GO GREATER THAN 50%, THEN YOU CAN'T FOLLOW THE PRESCRIPTIVE PATH. YOU HAVE TO USE THE ENVELOPE TRADE-OFF PROCEDURE OR THE ENERGY COST BUDGET METHOD. THOSE ALLOW YOU TO GO TO HIGHER LEVELS OF GLAZING. NOW, WHAT'S IMPORTANT TO RECOGNIZE WHEN YOU DO THAT, IS THAT THE BASIS FOR THE HIGHER LEVELS OF PERFORMANCE IS EQUAL ENERGY. THAT'S THE ONE EXCEPTION TO THE WHOLE STANDARD WHERE WE HAVE TRIED TO, BASED ON ECONOMICS. AT THIS POINT WE FELT WE NEEDED TO BASE IT ON ENERGY. WE ARE CAPPING IT AT 50% AS THE ENERGY CONSUMPTION FOR FENESTRATION. THANKS, THAT'S AN IMPORTANT COLLABORATION. IF WE COMPARE THE FENESTRATION U-FACTORS AROUND THE COUNTRY, AGAIN WE SEE SINGLE GLAZING UP TO ABOUT 3,000 HEATING DEGREE-DAYS AND NOT TOO DISSIMILAR FROM WHAT WAS IN THE '89 STANDARD. HERE WE HAVE THE CRITERIA SHOWING FOR 30% WINDOW WALL RATIO, WHICH WAS THE BASIS FOR THE '89 STANDARD. I HAVE SHOWN THE U-VALUES THERE. AT ST. LOUIS WE ARE ESSENTIALLY LOOKING AT ALMOST IDENTICALLY THE SAME CRITERIA. IF IT'S OPERABLE, IT'S A LITTLE MORE STRINGENT IF IT'S FIXED GLAZING. IN TERMS OF SOLAR HEAT GAIN COEFFICIENT REQUIREMENTS; IN '89 STANDARD WE SEE A TREMENDOUS SCATTER ASSOCIATED WITH ALL OF THE BLUE LOCATIONS. WHAT'S SHOWN HERE ARE THE 234 LOCATIONS FROM THE '89 STANDARD WHERE WE HAVE ALL THE WEATHER DATA TO BE ABLE TO CALCULATE THE CRITERIA. IN THE 1999 VERSION WE HAVE DISCRETE LEVELS OF SOLAR HEAT GAIN. AS YOU MIGHT IMAGINE, IT STARTS OUT AND CHANGES AS YOU GET INTO PREDOMINANTLY MORE COOLING AND THEN JUMPS BACK UP. IT'S HARD TO SEE HOW THIS CRITERIA REFLECTS WHEN YOU ARE ONLY USING ONE OF THE TWO METRICS FOR THE CRITERIA. HERE IT IS JUST HEATING DEGREE-DAYS, BUT IT IS SOLAR HEAT GAIN VALUES THAT ARE RARELY AVAILABLE ON COMMON PRODUCTS. FINISHING UP WITH THE FENESTRATION, WE HAVE SEPARATE CRITERIA FOR SKYLIGHTS, AND THAT'S BROKEN DOWN INTO THREE CATEGORIES DEPENDING ON WHETHER IT HAS A CURVE OR NOT. THE TYPE OF FENESTRATION MATERIAL, WHETHER IT'S GLASS OR PLASTIC AND THEN IT'S FURTHER SUBDIVIDED AS A PERCENT OF THE ROOF AREA BETWEEN ZERO AND 2% IS ONE SET OF CRITERIA. 2 TO 5% IS THE SECOND LEVEL OF CRITERIA. THE U-FACTORS IN THIS CASE FOR ST. LOUIS, THEY ARE THE SAME, BUT AS YOU INCREASE THE AREA, THE SOLAR HEAT GAIN COEFFICIENT DECREASES. WE COMPARE THAT TO THE 1999 STANDARD, WE ARE LOOKING AT ESSENTIALLY A REDUCTION IN STRINGENCY ON U-FACTORS BECAUSE THE '99 STANDARDS ARE HIGHER THAN WHAT WAS REQUIRED IN '89. IF WE ARE LOOKING AT ST. LOUIS, WE ARE LOOKING AT ONE PARTICULAR TYPE WOULD BE THE SAME CRITERIA. LOOKING AT GLASS AND PLASTIC THERE ARE LESS STRINGENT REQUIREMENTS FOR THE U-FACTOR. THE SOLAR HEAT GAIN COEFFICIENT, AGAIN HAS A LOT OF COMBINATIONS DEPENDING ON THE

TYPE OF GLASS OR PLASTIC THAT'S USED AND FOR ST. LOUIS, WE ARE SEEING NO COMPARISONS TO THE '89 STANDARD SHOW UP HERE BUT THIS IS THE NEW CRITERIA THAT WOULD HAVE TO BE MET. ALL RIGHT, THAT'S A LOT OF DETAIL ON THE SPECIFIC ELEMENTS OF THE ENVELOPE CRITERIA. NEXT THING YOU NEED TO DO IS BE ABLE TO DEMONSTRATE COMPLIANCE AND WE'VE MARCHED THROUGH THE MANDATORY REQUIREMENTS, THE PRESCRIPTIVE. YOU CAN USE R-VALUES OR FOR INDIVIDUAL COMPONENTS LOOK AT U-FACTORS, CONTRIBUTION FACTORS, F-FACTORS. IF THOSE PRESCRIPTIVE COMPLIANCE PADS AREN'T USED, GO TO THE ENVELOPE TRADE-OFF PROCEDURE THAT IS AVAILABLE WITH PURCHASE A COPY OF THE USER'S MANUAL, OR YOU CAN DO A WHOLE BUILDING TRADE-OFF CALCULATION USING SECTION 11 OF THE ENERGY COST BUDGETS IN THE STANDARD. AS I START TO WIND DOWN, I WOULD LIKE TO STEP THROUGH THE APPENDICES THAT ARE INCLUDED IN THE STANDARD. THESE ARE NORMAL APPENDICES, WHICH MEANS THEY ARE PART OF THE STANDARD. FIRST WE HAVE APPENDIX A WHICH LIST VARIOUS ASSEMBLIES FOR ROOFS, WALLS, FLOORS, FENESTRATION IN TERMS OF U-FACTORS, C-FACTORS FOR FOUNDATIONS, SLABS F-FACTORS. THESE TABLES PROVIDE LEVELS OF ACCEPTABLE CONSTRUCTION. THEY ALSO LIST PROCEDURES ON HOW TO PERFORM ACCEPTABLE CALCULATIONS FOR THOSE CONSTRUCTIONS THAT ARE NOT SPECIFICALLY LISTED IN THE APPENDIX. YOU CAN GO THROUGH AND USE THESE PROCEDURES TO ESSENTIALLY ANALYZE ANY CONSTRUCTION ELEMENT YOU WANT TO PUT INTO THE DESIGN OF THE BUILDING. APPENDIX B CONTAINS THE 26 CRITERIA TABLES. NOBODY WILL NEED ALL OF THESE. YOU WILL HAVE TO GO THROUGH AND DEFINE FOR THE SPECIFIC CONSTRUCTION SITE THE ONE TABLE THAT'S APPLICABLE USE THAT THE REST OF THEM ARE THERE FOR REFERENCE BUT YOU WILL PROBABLY ONLY BE USING ONE PER CONSTRUCTION SITE. APPENDIX C CONTAINS THE ENVELOPE TRADE-OFF PROCEDURE EQUATIONS AND RULES. IT DEFINES THE MODELING OF THE PROPOSED BUILDING AND THE BASE BUILDING THAT YOU MUST USE. IT PRESENTS THE EQUATIONS TO USE IN THE TRADE-OFF. THESE EQUATIONS ARE BUILT INTO THE PROGRAM. IT ACCOUNTS FOR INTERACTIONS OF ROOF CEILINGS, WALLS, FENESTRATION, FOUNDATIONS AS WELL AS HVAC EQUIPMENT, LIGHTING AND INTERNAL GAINS. ALTHOUGH THEY ARE NOT TRADE-OFF VARIABLES. WHAT I AM TRYING TO DEPICT IS ALL THE INTERACTIONS VERY COMPLEX. WHEN YOU USE THE ENVSC PROGRAM, YOU HAVE TO RECOGNIZE THE PROPOSED BUILDING YOU WANT TO BUILD HAS TO EQUAL THE BASE BUILDING. IT HAS TO HAVE THE SAME FLOOR AREA, SAME SLAB PERIMETER, SAME GROSS WALL AREA, SAME OPAQUE DOOR AREA, GROSS FLOOR AREA, SPACE-CONDITIONING CATEGORIES HAVE TO BE THE SAME. THE EXCEPTION TO THIS IS THAT FENESTRATIONS HAVE TO BE THE SAME UNLESS YOU'RE GREATER THAN 40% WINDOW WALL RATIO THAT IS CAPPED AT 40% IN THE PROGRAM AND SKYLIGHTS ARE CAPPED AT 5%. SO, THOSE ARE A COUPLE OF THINGS YOU NEED TO BE AWARE OF.

SO THE TWO BUILDINGS HAVE TO LOOK THE SAME. YOU CAN'T FIGURE YOU WILL DESIGN ONE AND BUILD SOMETHING THAT LOOKS A LITTLE BIT DIFFERENT. SIMILARLY, IF YOU ARE USING THE ENERGY COST BUDGET METHOD IN SECTION 11, THAT DEFINES A RULE FOR MODELING THE REPOSED BUILDING, AS WELL AS THE BASE BUILDING. YOU CAN'T MODEL A THREE-STORY OFFICE BUILDING AND THEN BUILD A SEVEN-STORY BASKET BUILDING SHOWN ON THE RIGHT. THIS ALLOWS YOU TO HAVE ALL TRADE-OFFS BETWEEN THE ENVELOPE, MECHANICAL AND LIGHTING STANDARDS. THIS IS COMPLETE FLEXIBILITY. WE HAVE TALKED A LOT ABOUT CLIMATIC DATA. IN APPENDIX D WE PRESENT TABLES FOR THE UNITED STATES. WE HAVE LISTED 650 SITES AND IF YOU CAN'T USE ONE OF THOSE, AS I MENTIONED EARLIER, SELECT ONE CLOSE TO THAT OR USE HISTORICAL DATA IF IT'S AVAILABLE. THERE IS ALSO DATA FOR CANADA, 86 SITES. INTERNATIONALLY WE HAVE 140 SITES SPREAD ACROSS 64 COUNTRIES. THIS GIVES US THE ABILITY TO CALL IT AN INTERNATIONAL STANDARD BECAUSE WE HAVE WEATHER DATA COVERING ALL THOSE CLIMATIC LOCATIONS. IN CLOSING ON THE LAST COUPLE TOPICS, FIRST IS THERE ARE ERRATA THAT HAVE BEEN PUBLISHED. THESE ARE PRIMARILY EDITORIAL CORRECTIONS. THEY ARE AVAILABLE ON THE ASHRAE WEBSITE. IF YOU BUY A COPY OF THE STANDARD, THEY ARE INCLUDED WITH THE PURCHASE OF THE STANDARD. WE ARE ALSO UNDER CONTINUOUS MAINTENANCE AND THAT MEANS WE ARE CONSTANTLY CHANGING THE STANDARD. WE HAVE PUBLISHED MANY ADDENDA. CURRENTLY THERE ARE 12 THAT ARE APPROVED. THEY ARE INCORPORATED IN EACH REPRINT OF THE STANDARD. THEY ARE ALSO AVAILABLE ON THE ASHRAE WEBSITE LISTED SOME OF THE KEY ADDENDA THAT EFFECT THE ENVELOPE, AND I AM NOT GOING TO GO THROUGH THE INDIVIDUAL DETAILS BECAUSE WE ARE GETTING CLOSE TO RUNNING OUT OF MY ALLOTTED TIME. SO WITH THAT, WE WILL ENTERTAIN ANY QUESTIONS FROM THE AUDIENCE OR ANY PLACE ACROSS THE COUNTRY. OKAY, YOU SHOULD HAVE SEEN ON THE SCREEN, OR SHOULD SEE ON THE SCREEN NOW THE PHONE NUMBERS TO CALL IN AND FAX IN. WE WELCOME OUR NATIONAL AUDIENCE TO PARTICIPATE IN THE SORT OF LIVE QUESTION AND ANSWER HERE AND ALSO WOULD ENCOURAGE THE STUDIO AUDIENCE, IF THEY HAVE A QUESTION, TO CHIME IN WHERE APPROPRIATE. I HAVE TO ASK ONE, MERYL, YOU HAD THE BASKET BUILDING WITH CURRENT COMPUTER TECHNOLOGY IT'S CLEARLY EASY TO CUT AND PASTE PICTURES TOGETHER HERE. HAVE YOU DONE THAT WITH THAT PARTICULAR EXAMPLE JUST TO MAKE THE POINT? NO, RON THAT THAT'S A REAL BUILDING IN NEWARK, OHIO WHERE -- CLOSE TO WHERE I LIVE. IT’S A CORPORATE OFFICE BUILDING FOR A COMPANY THAT MANUFACTURERS HOME WEAVED BASKETS. SO IT'S REAL. OKAY, WE CAN GET BUILDINGS OF ALL TYPES HERE. AGAIN, THE NUMBER IS ON YOUR SCREEN. HOPEFULLY, AMERICA, YOU RE OUT THERE AND SOMEBODY IS DIALING IN ON THE PHONE SENDING US A FAX. I SEE WE HAVE SOMEBODY FROM OUR STUDIO AUDIENCE THAT WOULD

LIKE TO ASK A QUESTION. GOOD DAY, MY NAME IS RANDY BARITHER, MY QUESTION IS: WHY ARE THERE ONLY 26 OF THE CLIMATE ZONE BINS? DO WE NEED TO REPEAT THE QUESTION? NO, I THINK YOU CAN HEAR THAT OUT THERE. ALL RIGHT, GOOD QUESTION. WHEN WE FIRST DID OUR DETERMINATION OF CLIMATIC DATA, WE STARTED WITH 73 CLIMATE BINS AND SENT THAT OUT FOR CONSIDERATION AND FOUND THAT IT WAS -- A LOT OF THE BINS HAD VERY SIMILAR CRITERIA. SO TO SIMPLIFY THE STANDARD AND REDUCE THE BULK SIZE, WE REDUCED IT FROM 73 TO 26 CLIMATE BINS. OKAY, I UNDERSTAND WE HAVE A CALL. CAN YOU GO AHEAD, CALLER? YEAH, HI, THE RESIDENTIAL AND NONRESIDENTIAL CRITERIA. IN THE RESIDENTIAL CRITERIA YOU HAVE LISTED THE HOSPITALS, PENITENTIARY AND A COUPLE OF OTHER THINGS THAT I WOULD CONSIDER AS NONRESIDENTIAL. OKAY, FOR THE BENEFIT OF THE STUDIO AUDIENCE AND OTHERS WHO MAY NOT HAVE HEARD THAT, THE QUESTION WAS REGARDING THE RESIDENTIAL AND NONRESIDENTIAL CRITERIA. THE CALLER INDICATED THAT SOME OF THE SPACES THAT WERE SHOWN AS EXAMPLES OF RESIDENTIAL HOSPITALS AND PRISONS THIS CALLER WOULD CONSIDER A NONRESIDENTIAL AS OPPOSED TO A RESIDENTIAL. CAN YOU ELABORATE ON THAT? YES, THAT'S A GOOD POINT. WHEN YOU SELECT THE CRITERIA, IT IS DONE BY SPACE CONDITIONING CATEGORIES AND IT DOESN'T HAVE TO APPLY FOR THE ENTIRE BUILDING. SO IN A HOSPITAL YOU WOULD HAVE THE PATIENT ROOMS WOULD BE UNDER THE RESIDENTIAL CATEGORY, AND OTHER SPACES, OPERATING ROOMS WOULD BE UNDER THE NONRESIDENTIAL. SO A BUILDING DOESN'T RECEIVE JUST ONE SET OF CLASSIFICATION. IT CAN VARY DEPENDING ON THE SPACE CONDITIONING USE WITHIN THE BUILDING. OKAY, THANKS. WE HAVE SOME COMING IN HERE ON THE FAX. SO THIS ONE IS COMING FROM CHATTANOOGA, TENNESSEE. HELLO, WHAT IS THE R-VALUE FOR 8-INCH AAC BLOCK? NOW, I WAS AFRAID WE WOULD GET A QUESTION LIKE THIS. WELL, I HAVE TO ACTUALLY REFER TO THE STANDARD. I THINK THERE ARE VALUES IN THE APPENDIX THAT LIST THOSE. IF IT'S NOT LISTED, THERE'S A METHOD THAT CAN BE USED TO CALCULATE THAT, I DON'T CARRY THAT AROUND IN MY HIP POCKET. WHICH APPENDIX? APPENDIX A? NO, APPENDIX B. SORRY, CALLERS, WE TRIED TO MEMORIZE ALL THE STANDARDS, BUT WE COULDN'T DO THAT. THERE ARE QUITE A FEW NUMBERS IN THERE, AND ITS DIFFICULT TO HAVE THAT IN THE HEAD. IF YOU GET THAT NEW STANDARD THAT ASHRAE WOULD LIKE TO SHIP TO YOU, YOU WOULD BE ABLE TO LOOK THE NUMBER UP YOURSELF. WHY ARE THERE SUCH DRASTIC DIFFERENCES IN SLAB ON GRADE INSULATION REQUIREMENTS BETWEEN THE '89 AND '99 EDITIONS? THE PRIMARY REASON FOR THE DIFFERENCES ARE IN TERMS OF THE ECONOMICS. IN TERMS OF OUR ANALYSIS, WE LOOKED AT NOT ONLY THE COST OF THE INSULATION, BUT WHEN YOU EXPOSE THAT INSULATION TO THE OUTSIDE, YOU ALSO HAVE TO HAVE A PROTECTIVE COVERING AND THE ENERGY SAVINGS HAS TO ACCOUNT FOR NOT ONLY THE COST OF THE INSULATION, BUT ALSO FOR THAT

PROTECTIVE COVERING THAT WAS VERY EXPENSIVE, AND THAT DIDN'T KICK IN UNTIL YOU GOT TO MUCH HIGHER HEATING DAY. I THINK WE HAVE A CALLER. HELLO, THIS IS BILL HODGE IN ARKANSAS. HOW ARE YOU DOING, BILL? GREAT, GUYS WOULD YOU PLEASE CLARIFY THE EXAMPLE OF THE DIFFERENT U-VALUES WHEN YOU TALKED BOUT IT'S NOT EQUIVALENT FOR ENERGY CONSUMPTION, BUT IT IS EQUIVALENT FOR COST EFFECTIVENESS. WOULD YOU PLEASE ELABORATE ON THAT? I'LL HANG UP FOR THE ANSWER. THE QUESTION IS, COULD WE CLARIFY THE DIFFERENT U-VALUES YOU HAD FOR THE DIFFERENT ASSEMBLIES WHERE YOU SHOWED EXAMPLES. YOU TALKED WITH EQUAL ENERGY AND COST EFFECTIVENESS. COULD YOU CLARIFY THAT? CERTAINLY, RON. THAT'S A VERY KEY POINT IN THE DEVELOPMENT OF THE STANDARD. I WILL GO BACK TO THE EXAMPLE I CITED EARLIER. IF YOU ARE LOOKING AT ROOF INSULATION YOU CAN USE RIDGED INSULATION ABOVE DECK. IT IS AT A CERTAIN PRICE. OR YOU CAN USE LIGHT DENSITY INSULATION UNDERNEATH THE DECK, AND THAT IS A DIFFERENT COST. WHAT WE LOOKED AT IN TERMS OF ECONOMIC ANALYSIS IS WHAT LEVEL OF R-VALUE MEETS OUR COST EFFECTIVENESS CRITERIA. IF YOU ARE USING AN EXPENSIVE MATERIAL, YOU CAN ONLY COST JUSTIFY CERTAIN LEVEL OF R-VALUE. IF IT'S LESS EXPENSIVE MATERIAL, YOU CAN COST JUSTIFY MORE. SO DEPENDING ON THE CONSTRUCTIONS, AND THE MATERIALS, AND THEIR FIRST COSTS, YOU END UP WITH DIFFERENT U-FACTOR REQUIREMENTS. OKAY, LET ME GO TO ONE OF OUR FAX QUESTIONS IF I MIGHT. THIS IS FROM JOHN IN CLEVELAND, OHIO, NEAR YOUR HOME. THE UNHEATED SLABS, SLAB ON GRADE CONSTRUCTION INSULATION IS NO LONGER REQUIRED? THE QUESTION, I GUESS, THERE'S NO LONGER REQUIRED FOR UNHEATED SLABS AND SLAB ON GRADE CONSTRUCTION? THAT IS CORRECT. FOR CLEVELAND, THAT WOULD BE LESS THAN 9,000 HEATING DEGREE-DAYS. IF MEMORY SERVES ME CORRECT THAT WAS THE BREAK POINT. OKAY, ANOTHER QUESTION FROM CHATTANOOGA, TENNESSEE. HOW DO YOU PURCHASE ENVSC 4.0? ARE THERE ANY OTHER SOFTWARE PACKAGES AVAILABLE? YOU PURCHASE ENVSC AS PART OF THE USER'S MANUAL. IF YOU ORDER THE USER'S MANUAL FROM ASHRAE, YOU WILL GET A COPY ON CD OF THE SOFTWARE PROGRAM. AS FAR AS I KNOW NOBODY ELSE HAS GONE THROUGH AND TAKEN THE EQUATIONS IN APPENDIX C AND IMPLEMENTED THEM IN A SOFTWARE PACKAGE. I ALSO BELIEVE IT MAY BE AVAILABLE FOR DOWNLOAD FROM THE DEVELOPER'S SITE. THAT MAY BE ANOTHER PATH TO GET IT IF YOU DIDN'T GET IT AS PART OF THE USER'S MANUAL. WE HAVE ANOTHER CALL-IN QUESTION. YES, I'M FROM AUSTIN, TEXAS. I HAVE A QUESTION. WHEN YOU HAVE BROUGHT DOWN THE USE TO 26 LEVELS, WILL THAT COLOR THE HEART REGION OF TEXAS WHERE WE HAVE VERY LITTLE WHAT WE CALL HEATING DAYS AND LOTS MORE COOLING DAYS? OKAY, THANK YOU FOR THE QUESTION. THE QUESTION IS: WE'VE BINNED DOWN THE CLIMATE TO 26 BINS. THIS IS A CALLER FROM AUSTIN, TEXAS WHO IS CONCERNED ABOUT TREATMENT

OF THE STANDARD IN THE HOT CLIMATES THAT ARE CHARACTERISTIC OF TEXAS. IF YOU BIN THEM DOWN TO 26 BINS, WILL THAT ADEQUATELY COVER SOME OF THE HOTTER REGIONS OF THE UNITED STATES, SUCH AS TEXAS? THAT WAS OUR OBJECTIVE. WE LOOKED AT COOLING AS ONE OF THE MAJOR THINGS WE WANTED TO INCORPORATE INTO THE STANDARD. IT WAS OUR INTENT TO DO EXACTLY THAT. THE CRITERIA IS SENSITIVE AS A FUNCTION TO BOTH HEATING AND COOLING. WE SEE THAT WE HAVE INCLUDED THAT WHETHER IT'S ADEQUATE OR SUFFICIENT, THAT DETERMINATION IS MADE BY THE COMMITTEE AND WENT THROUGH THE PUBLIC REVIEW PROCESS BUT ALWAYS SUBJECT TO THE INDIVIDUAL INTERPRETATION. HAVE A COUPLE MORE FAX QUESTIONS HERE. THIS IS FROM ALAN IN NORTH JERSEY. HOW DOES THE CURVE AFFECT A SKYLIGHT? WHAT ARE THE DIFFERENT U-VALUES REQUIRED? THE CURVE IS PART OF THE OVERALL U-VALUE CALCULATION. THAT'S, I BELIEVE THERE'S A SEPARATE NFRC STANDARD THAT SPELLS OUT THE DETAILS. YOU ARE LOOKING AT THE OVERALL PERFORMANCE OF THE GLAZED AND OPAQUE PORTION OF THE SKYLIGHT TO DETERMINE THE OVERALL U-VALUE FOR INDIVIDUAL SKYLIGHTS. HERE COMES A TOUGH ONE. THIS IS FROM NEW JERSEY. DON'T HAVE THE SUBMITTER, BUT THE QUESTION IS: AM I TO UNDERSTAND THAT A MULTI-STORY OFFICE BUILDING REQUIRES FLOOR SLAB INSULATION? IF SO, WHAT'S THE RATIONALE? SLAB INSULATION IS ONLY REQUIRED AT THE GROUND LEVEL. IF YOU ARE LOOKING AT A MULTI-STORY FLOOR, THERE'S NO REQUIREMENT FOR SLAB INSULATION AT THE INTERMEDIATE FLOORS. IT'S ONLY IN CONTACT WITH THE GROUND WHERE YOU WOULD HAVE THE REQUIREMENT. OKAY, ANOTHER FAX QUESTION HERE. LET'S SEE. WHAT SOFTWARE OR PROCEDURES CAN BE USED FOR ENERGY COST BUDGETS? UM -- THE SECTION ALLOWS COMMERCIAL CODES TO BE USED. IT DOESN'T REQUIRE A SPECIFIC ONE. IT LISTS THE CHARACTERISTICS THAT MUST BE MET. FOR INSTANCE, AN 8760 CALCULATION, BUT IT DOESN'T DEFINE A SPECIFIC PROPRIETARY OR COMMERCIALLY AVAILABLE PROGRAM THAT MUST BE USED. IT'S UP TO THE INDIVIDUAL USER TO MAKE THE SELECTION. THERE ARE A NUMBER OF PRODUCTS ON THE MARKET THAT ARE AVAILABLE. ABSOLUTELY. YES. YES. WE HAVE A CALLER ON THE LINE, I BELIEVE. GO AHEAD CALLER. AM I ON? AM I HERE? GO AHEAD. YES CALLING FROM ST. LOUIS, MISSOURI THE HOME OF THE CURRENT PRESIDENT, BILL COE, AND ALSO THE 6-1 ST. LOUIS RAMS. THE QUESTION IS: IS THERE ANY COORDINATION AT THIS POINT IN TIME BETWEEN THE ASHRAE 62 AND THE ASHRAE 90 STANDARD? MAYBE YOU WANT TO DEAL WITH THIS LATER IN THE PROGRAM. MY QUESTION IS REALLY TO DEAL WITH V.A.B. AND REHEATING SYSTEM. IS THAT SOMETHING YOU TALKED ABOUT ENERGY CALCULATIONS? IS THERE A CORRELATION THAT WOULD WORK INTO THE CURRENT 90 STANDARD THAT GIVES 62 LEEWAYS TO COMPLY WITH THAT? I THINK, CALLER, THE QUESTION WAS, FOR THE STUDIO AUDIENCE WHO ARE UNABLE TO HEAR THIS, THE QUESTION IS: IS THERE ANY COORDINATION BETWEEN

STANDARD 62 AND STANDARD 90.1. I THINK THAT QUESTION MAY BE MORE APPROPRIATE IN THE MECHANICAL SECTION AND MICK'S ACROSS THE ROOM LOOKING AT ME KIND OF FUNNY. I THINK I WILL LET YOU OFF THE HOOK ON THAT ONE, MERYL. I THINK THAT'S FOR MICK WHEN IT COMES UP. THANK YOU. I HAVE ANOTHER FAX IN HERE. APPROXIMATELY ONE TO TWO MINUTES. THIS IS COMING FROM SALT LAKE CITY, UTAH. THANKS FOR CAUSING US TO BE EFFICIENT. COULD YOU PINPOINT THE MAJOR DIFFERENCES BETWEEN THE '89 AND '99 VERSIONS OF THE STANDARD 90 BUILDING ENVELOPE? WELL, AS I TRIED TO PRESENT IN THE BEGINNING OF THE PRESENTATION, OVER ALL, IF YOU LOOK AT A NATIONAL LEVEL, THE STRINGENCY FOR THE BUILDINGS THAT WE LOOKED AT, THE OFFICE AND RETAIL AND 11 DIFFERENT CLIMATE ZONES, THE STRINGENCY WAS 2 OR 3% MORE STRINGENT IN 1989. IF YOU LOOK AT INDIVIDUAL CITIES, WE PRESENTED A GRAPH THAT SHOWED THE DETAIL BY HEATING DEGREE-DAYS THERE CAN BE RATHER SUBSTANTIAL DIFFERENCES NOT ONLY DUE TO CLIMATE LOCATIONS BUT DUE TO DIFFERENCES IN CONSTRUCTION FEATURES. SO OVER ALL, IT'S A LITTLE MORE STRINGENT. INDIVIDUALLY IT COULD BE QUITE A BIT DIFFERENT. THANKS. WE HAD ANOTHER FAX QUESTION FROM A DIFFERENT LOCATION THAT SEEMED TO BE A SIMILAR. DENNIS OUT IN, WHEREVER THE HECK THIS FAX CAME FROM BELTSVILLE, MARYLAND. HERE'S ONE ON FENESTRATION. THE QUESTION IS FROM GRAND RAPIDS, MICHIGAN. WHEN ARE YOU REQUIRED TO USE APPENDIX VALUES FOR THE CRITERIA VERSUS MANUFACTURED SUPPLIED DATA? WHAT IF THE MANUFACTURED DATA IS NOT NFRC RATED? THE REQUIREMENTS OF THE STANDARD FOR UNITS THAT ARE COMMERCIALLY AVAILABLE AND COULD BE BOUGHT BY CONSUMERS THAT YOU NEED TO HAVE THE NFRC RATING. HOWEVER THERE'S A SERIES OF EXCEPTIONS AND THOSE APPLY TO THE VALUES THAT ARE LISTED AS DEFAULTS IN APPENDIX A FOR CONSTRUCTION THAT ARE NOT LISTED BY NFRC RATINGS. WITH THAT YOU HAVE TO USE THE DEFAULT VALUES AND THEY WOULD BE A LITTLE MORE STRINGENT THAN WHAT YOU WOULD HAVE IF YOU ACTUALLY HAD THE UNIT SPECIFICALLY RATED, THOUGH, SO THERE'S AN INCENTIVE TO USE RATED PERFORMANCE RATHER THAN THE DEFAULT TABLES THEMSELVES. OKAY, WE HAVE ANOTHER CALLER ON THE LINE. GO AHEAD, CALLER. HELLO. HELLO. DAVE, IN SALT LAKE CITY I HAVE A QUESTION FOR YOU. HI, DAVE. WHEN WILL THE NEW STANDARD BE IMPLEMENTED? IS THERE A SCHEDULE FOR THIS? WE GOT IN A LITTLE LATE. I JUST WANTED TO ASK THAT QUESTION AND ALSO, TO BE ABLE TO RUN THE EVALUATION THAT IS PROVIDED THROUGH THE COM-CHECK SOFTWARE TO BE ABLE TO PROVIDE THE REPORTS AND EVALUATION TO INSPECTORS. IS THERE A CRITERIA TO BE ABLE TO PROVIDE THAT REPORT AS AN INDIVIDUAL? DO WE NEED TO BE CERTIFIED SOMEHOW? HOW DO WE GET EXTRA TRAINING AND STUFF? OKAY, DAVE'S QUESTION, FOR THE STUDIO AUDIENCE, WAS TWO-FOLD. ONE WAS, WHEN WILL THE NEW STANDARD BE IMPLEMENTED? THE IMPLEMENTATION OF THE

STANDARD IS REALLY UP TO HE STATE AND LOCAL JURISDICTIONS. WE SHOWED A MAP AT THE BEGINNING OF THE BROADCAST THAT INDICATED THE STATUS OF THE VARIOUS STATES AND WHERE THEY WERE IN TERMS OF ADOPTING THIS AND SO THAT'S REALLY A STATE AND LOCAL ISSUE. THE SECOND QUESTION ABOUT COM-CHECK SOFTWARE AND REPORTS FOR INSPECTORS AND GETTING TRAINING ON THAT. IF YOU GO TO THE DUE WEBSITE THERE'S INFORMATION ON COM-CHECK. THERE'S ALSO INFORMATION ON THE TRAINING OPPORTUNITIES THAT ARE OFFERED. SO HOPEFULLY THAT WILL BE ABLE TO ANSWER THE SPECIFIC QUESTIONS AND THAT WEBSITE LOCATION, I BELIEVE SHOULD BE APPEARING ON THE SCREEN RIGHT NOW. IT'S A LITTLE BIT LONG FOR ME TO SAY. HOPEFULLY YOU HAVE A PENCIL AND ARE COPYING FAST. I SEE WE ARE RUNNING OUT OF TIME HERE. SO I APOLOGIZE. THERE ARE A COUPLE OF QUESTIONS WE DIDN'T GET TO, BUT WE WERE HAPPY YOU SENT THE THINGS IN. I WOULD LIKE TO MAKE A FEW COMMENTS. YOU PROBABLY ALL WANT TO KNOW WHERE YOU CAN GET THE STANDARD. IF YOU DIDN'T JOIN US AT THE BEGINNING, AND APPEARING ON YOUR SCREEN NOW, HOPEFULLY, IS THE GRAPHIC WITH THE INFORMATION FROM THE ASHRAE BOOKSTORE ON HOW YOU CAN GET THE STANDARD, EITHER THROUGH THE WEBSITE OR THROUGH CALL IN. I WOULD LIKE TO THANK ALL OF YOU FOR JOINING US FOR THIS FIRST SEGMENT. BOTH OUR NATIONAL AUDIENCE, AS WELL AS THE FOLKS FROM THE INLAND EMPIRE CHAPTER HERE IN OUR STUDIO AUDIENCE, THANKS, AGAIN. WE HOPE YOU WILL BE BACK FOR THE SUBSEQUENT SEGMENTS. IF YOU WANT MORE, AFTER THIS IS OVER, IF WE HAVEN'T GIVEN YOU ENOUGH IN THE APPROXIMATE FOUR HOURS OR SO THAT WE WILL BE WITH YOU AND WANT MORE, BE AWARE THAT ASHRAE HAS PROFESSIONAL DEVELOPMENT SEMINARS. THESE WILL BE TWO-DAY SEMINARS THAT GO INTO CONSIDERABLE MORE DETAIL ON THE STANDARD. THE FIRST OF THOSE WILL OCCUR JANUARY 11TH AND 12TH IN ATLANTIC CITY IN CONJUNCTION WITH THE ASHRAE MEETING. THERE ARE TWO TENTATIVE SUBSEQUENT DATES MAY 15TH AND 16TH IN ST. LOUIS, BOY, WHEN YOU HAVE A PRESIDENT IN ST. LOUIS, EVERYBODY POINTS THAT DIRECTION, DON'T THEY, AND NOVEMBER 20TH AND 21ST IN BALTIMORE, MARYLAND. CHECK THE ASHRAE WEBSITE FOR THOSE THINGS TO BE CONFIRMED. I WOULD LIKE TO ADD, PLEASE COMPLETE THE SIGN-IN SHEETS AND EVALUATION FORMS THAT YOU HAVE AVAILABLE AND SUBMIT THEM BACK TO US. THIS IS IMPORTANT FOR OUR SPONSORS, AND IMPORTANT FOR OUR QUALITY IMPROVEMENT PROCESS. IT'S ACTUALLY HOW WE KNOW YOU ARE REALLY OUT THERE. PLEASE DO THAT NOW. WE WILL BE BACK AT 1:30 P.M. EASTERN TIME FOR THE NEXT SEGMENT, THE MECHANICAL PRESENTATION. SO UNTIL 1:30 GOOD-BYE, HANG BY YOUR TELEVISION AND FILL OUT THE EVALUATION FORMS. THANKS FOR WATCHING.